

A NEW SUBGENUS OF *FORCIPOMYIA*, WITH DESCRIPTIONS OF
EIGHT NEW SPECIES (DIPTERA: CERATOPOGONIDAE)

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Abstract.—*Pedilohelea* new subgenus in the biting midge genus *Forcipomyia*, is described and illustrated, with *F. clastrieri* Dessart as type-species. A key is given for the separation of the 10 known species, including the following eight species described as new: *aitkeni* from Brazil, *archboldi* from Dominica, *brinchangensis* from Malaysia, *draconis* from South Africa, *forcipis* from Malaysia, *raposoi* from Colombia, *spangleri* from Guatemala, and *spilmani* from Dominica. The known species of *Pedilohelea* are pantropical in distribution. The habits of the early stages are unknown; adults have been taken in flowers of cacao and may be of some importance in pollination as in other species of *Forcipomyia*.

The classification of the small, inconspicuously brownish, hairy, biting midges of the genus *Forcipomyia* Meigen has received increasing attention during the past 20 years because of their importance in the pollination of cacao (*Theobroma cacao* L.) and other tropical crop plants. Numerous subgenera have been proposed in this large and widespread genus, and Wirth and Ratanaworabhan (1978) recently published a revised key to the subgenera. We are taking this opportunity to describe another subgenus with ten species that do not fit in any of the previously described subgenera. Unless otherwise specified, the material studied is from the collection of the U.S. National Museum of Natural History in Washington, D.C.

Forcipomyia (*Pedilohelea*) de Meillon and Wirth, NEW SUBGENUS

Type-species.—*Forcipomyia clastrieri* Dessart.

Members of this new subgenus are small midges (wing length 0.7–1.3 mm), without any distinctive markings, and generally resemble one another

very closely. The male genitalia present the main features for separating the species; the females cannot be identified with any certainty except in the case of *F. spangleri*, n.sp. In both sexes the costa barely reaches the middle of the wing (costal ratio 0.39–0.47), the palpus is four-segmented, and its third segment bears a vestigial or shallow and poorly marked sensory pit. The female mandibles lack teeth. The antennal verticils of the female are long and stiff, more so than usually found in species of the genus; the antennal segments are comparatively elongate; the antennal ratio is about 0.9–1.2 in the male and 0.9–1.3 in the female. The tarsal ratios are less than 0.7 on all legs except in *F. spangleri*, where these ratios are 0.8–1.2, and in *brinchangensis*, n.sp., where the female fore tarsal ratio is 0.9. The comb at the apex of the hind tibia, commonly seen in *Forcipomyia*, is poorly developed, but the fore tibia bears a compact comb of fine pale setae, often difficult to see. Tarsomeres I and II of the fore leg each bear ventrally a row of short, strong, black spines, and usually some or all of the remaining proximal four tarsomeres bear strong apical dark spines. The claws are usually very small, abruptly bent in the middle and expanded spear shaped distally, resembling those of the subgenus *Warmkea*. The insect bears an abundance of narrow, 1–4 striped, scalelike setae, especially on the costa and radial veins of the wing. The halter is usually distinctly infuscated. Females have two subequal spermathecae, usually without distinct necks. The male genitalia have the parameres broadly joined basally and more or less bladelike distally and provide the best characters for identification of the species.

The new subgenus comes near *Metaforcipomyia* Saunders, from which it is separated by the hind tarsal ratio in both sexes of 1.0 or less, and by the characteristic male genitalia. In the key to subgenera of *Forcipomyia* in Wirth and Ratanaworabhan (1978) *Pedilohoelea* is found in the first half of couplet 7 as "genus [sic] A near *Lepidohelea* Kieffer." Soria (1976) and Soria and Wirth (1976) referred to this subgenus as "Subgenus 1 near *Lepidohelea*."

Etymology.—The name *Pedilohoelea* is an anagram of *Lepidohelea* Kieffer, another subgenus of the genus *Forcipomyia* Meigen.

Biology.—Nothing is known of the biology of the early stages and very little about that of the adults. With the exception of one species reared by Soria in the laboratory (Soria 1976, Soria and Wirth 1976), the rest have all been taken at light, in Malaise and light traps, or swept from vegetation. Soria's 18 specimens include two females which cannot be identified positively, but judging from the shapes of the spermathecae probably belong to *Pedilohoelea*. These females are accompanied by a larva and a pupal skin with the larval skin attached in typical *Forcipomyia* fashion, which bear the same data as the females. This material, however, is too meager to warrant description or an attempt to define it subgenerically. On the island of São

Tomé (West Africa) males and females of *F. clastrieri* Dessart were taken in cacao flowers.

Distribution.—The distribution of the subgenus is pantropical, species having been collected in tropical America, West Africa, South Africa, and Malaysia.

Note.—Because all the species described here share the following characters, these will not be repeated under each species, namely: small size; lack of ornamentation; four-segmented palpus, with segment III slightly longer than IV or equal to it; tibial combs poorly developed; claws small and sharply bent; empodium well developed; and eyes narrowly separated, bare.

KEY TO THE SPECIES OF THE SUBGENUS *PEDILOHELEA* (PRIMARILY MALES)

- 1. Male genitalia with each paramere expanded distally into triangular shape (Fig. 33); (aedeagus with apex produced to a broad rounded termination [Fig. 33]) *raposoi*, new species
- Male paramere parallel sided, slightly expanded or narrowed to apex .. 2
- 2. Dististyle in ventral view grossly expanded apically, truncated or in form of two lobes (Figs. 15–16); (female spermathecae pear shaped with narrow opening [Fig. 18]) *aitkeni*, new species
- Dististyle narrowed to apex or only slightly expanded 3
- 3. Paramere with free distal arm short, stiff, sclerotized (Figs. 31, 46) 4
- Paramere with free distal arm long, membranous (Figs. 21, 38, 44) .. 7
- 4. Paramere in side view slightly expanded at apex and shaped as in Figs. 27–28; (spermathecae egg shaped with a wide opening [Fig. 25]) *brinchangensis*, new species
- Paramere parallel sided or narrowed to apex 5
- 5. Aedeagus (Fig. 29) with distal portion parallel sided, apex trilobed; dististyle stout on basal $\frac{2}{3}$, abruptly narrowing distally; parameres distally forming a stout, slightly curving, blunt-tipped blade *draconis*, new species
- Aedeagus triangular, narrowing to sharp-pointed simple tip; dististyle sinuous, gradually tapering to tip; parameres various 6
- 6. Aedeagus pear shaped in ventral profile (Fig. 46); parameres bulbous basally (Fig. 31); West and South Africa *eshowensis* de Meillon
- Aedeagus triangular in ventral profile (Fig. 32); paramere straight sided basally (Fig. 31); Malaysia *forcipis*, new species
- 7. Parameres crossed apically as in a pair of scissors (Fig. 21) 8
- Parameres more or less parallel to one another, not crossed (Figs. 38, 44) 9
- 8. Paramere gradually widening to an evenly rounded apex (Fig. 21);

- apex of dististyle with a small dorsal flange (Fig. 20); Dominica . . .
 *archboldi*, new species
- Paramere gradually narrowing to sharply pointed apex (Fig. 12);
 apex of dististyle without such a flange (Fig. 12); West Africa
 *clastrieri* Dessart
9. Paramere long, slender, on a narrow base (Fig. 44); hind tarsal ratio
 near 0.40; (spermathecae subglobular with wide opening [Fig. 40])
 *spilmani*, new species
- Paramere broader and on a wider base, slightly expanded apically
 in some views (Fig. 38); hind tarsal ratio near 0.80; (spermathecae
 egg shaped, with a narrow opening [Fig. 35]) . . *spangleri*, new species

Forcipomyia (Pedilohelea) aitkeni de Meillon and Wirth, NEW SPECIES
 Figs. 13–18

Male.—Described from holotype with mean measurements from 9 paratypes in parentheses. Wing length 1.1 mm (1.07). *Head*: Palpus (Fig. 17) with 3rd segment slightly swollen on basal $\frac{1}{2}$, a demarcated sensory organ with capitate sensilla present at about the middle; in 3 of the 9 paratypes no definite demarcation of the organ could be seen. Antenna with lengths of segments XII–XV in proportion of 80-40-38-50 (69-39-32-39); antennal ratio (III–XI/XII–XV) = 0.90 (1.00). *Thorax*: Wing with costal ratio 0.40 (0.42). Legs with tarsal ratios of fore, mid, and hind legs 0.60, 0.36, 0.40 (0.60, 0.34, 0.43).

Genitalia (Figs. 13–16): Dististyle with apex expanded in form of 2 lobes or truncate and not expanded when viewed ventrally (Fig. 15), in side view with appearance variable but often as illustrated (Fig. 16). Aedeagus shield shaped, deeply notched anteriorly where it bears a long curved spinelike process best seen in side view (Fig. 14); though mostly membranous the basal border and a portion of the lateral borders are strongly sclerotized. Parameres in ventral view (Fig. 13) joined briefly; some distance from the base narrowing slightly to parallel caudal processes which do not cross one another; these processes ribbonlike with lateral margin sclerotized, the medial margin membranous and difficult to see.

Female.—With mean measurements from 7 specimens. Wing length 0.86 mm. *Head*: Palpus as in male but all specimens showing a demarcated sensory organ. Antenna with lengths of segments XI–XV in proportion of 20-20-25-30-35; antennal ratio (III–X/XI–XV) 1.20. *Thorax*: Wing with costal ratio 0.46. Legs with tarsal ratios of fore, mid and hind legs 0.70, 0.35, 0.44. *Abdomen*: Spermathecae (Fig. 18) two, pear shaped or oval; subequal, one measuring 0.050 by 0.037 mm, the other slightly smaller; somewhat variable, but generally as figured.

Distribution.—Brazil, Colombia.

Types.—Holotype, ♂, Belem, Pará, Brazil, March 1970, T. H. G. Aitken,

sticky trap (USNM Type no. 67551). Paratypes, 24 ♂, 14 ♀, same data as type, but March–July 1970.

Other Specimens Examined.—COLOMBIA: Rio Raposo, Valle, 10 June, 1, 28 July 1964, V. H. Lee, light trap, 1 ♂, 2 ♀.

Discussion.—This species is named for T. H. G. Aitken of the Rockefeller Foundation in appreciation of his interest and help in the collection and study of Brazilian and Trinidadian Ceratopogonidae.

We have seen two reared females with one larva and one pupa associated, plus 10 other females taken on cacao flowers or taken in emergence traps in cacao plantations at CEPEC, Ilheus, Bahia, Brazil, May–June 1974 by S. J. de J. Soria, that may belong here but in the absence of males it is better at this time to leave them unidentified.

F. aitkeni and *F. spangleri* form the exceptions to the general rule that specific differences are best seen in the male genitalia. No clear cut genital differences occur between these two species, but the tarsal ratios, both male and female, are so different that one is obliged to regard them as distinct species.

Forcipomyia (Pedilohelea) archboldi de Meillon and Wirth, NEW SPECIES
Figs. 20–23

Male.—Described from the holotype with the mean data from 7 paratypes from Dominica in parentheses. Wing length 0.9 mm (0.88). *Head*: Palpus (Fig. 23) with 3rd segment only slightly swollen on basal $\frac{1}{2}$, a patch of sensilla without a clearly demarcated sensory pit located at not quite mid-length (similar condition in the 7 paratypes). In a specimen from Belem, Brazil, the sensory organ is demarcated. Antenna with lengths of segments XII–XV in proportion of 70-35-30-35 (67-35-26-36); antennal ratio 1.0 (1.0). *Thorax*: Wing with costal ratio 0.4 (0.4). Legs with tarsal ratios of fore, mid, and hind legs 0.6, 0.4, 0.4 (0.6, 0.4, 0.4).

Genitalia (Figs. 20–22): Dististyle (Fig. 20) sinuous, of almost even width throughout, with a small dorsal flange at apex. Aedeagus (Fig. 21) triangular, terminating in a sharp transparent point which is difficult to see except when dissected out (Fig. 22). Parameres joined basally, crossed distally much as in *F. clastrieri*, but unlike that species each paramere is slightly expanded at the apex and evenly rounded (Fig. 21).

Female.—Described from 5 Dominican specimens. Wing length 0.85 mm. *Head*: Palpus much as in male with sensory pit not demarcated. Antenna with lengths of segments XI–XV in proportion of 22-23-23-23-31; antennal ratio 0.9. *Thorax*: Wing with costal ratio 0.4. Legs with tarsal ratios of fore, mid and hind legs 0.7, 0.5, 0.7. *Abdomen*: Spermathecae (Fig. 19) two, subglobular with wide opening; subequal, each measuring 0.038 by 0.031 mm.

Distribution.—West Indies, Brazil.

Types.—Holotype, ♂, Manets Gutter, Dominica, 15 March 1965, W. W. Wirth, light trap (USNM Type no. 67552). Paratypes, 16 ♂, 3 ♀: DOMINICA: Same data as types, 8 ♂, 2 ♀. Carholm Estate, 7 Feb. 1965, W. W. Wirth, sweeping, 1 ♂, 1 ♀. Clarke Hall, May–June 1964, O. S. Flint, light trap, 1 ♂; Aug.–Sept. 1964, T. J. Spilman, light trap, 5 ♂. Fond Figue River, 13 March 1965, W. W. Wirth, light trap, 1 ♂.

Other Specimens Examined.—BRAZIL: Belem, Pará, Feb., Aug. 1970, T. H. G. Aitken, light trap, 1 ♂. JAMAICA: Hardwar Gap, 20 Feb. 1969, W. W. Wirth, light trap, 8 ♂, 5 ♀; 10 March 1970, W. W. Wirth, Malaise trap, 5 ♂, 6 ♀. Portland Ridge, Clarendon Parish, Aug. 1969, R. E. Woodruff, light trap, 1 ♀. Trelawny Parish, 1.9 mi N Burnt Hill, 16 May 1969, R. E. Woodruff, 1 ♂. Tyre, 2 mi NW Troy Cockpit, 9 Dec. 1969, R. E. Woodruff, 1 ♂. Worthy Park Estate, St. Catherine Parish, 17 Nov. 1968, R. E. Woodruff, light, 1 ♀. PUERTO RICO: Barrio Rio Grande, El Verde, G. E. Drewery, sticky trap, 2 ♂.

Discussion.—This species is named for John Archbold in appreciation of his interest and support of the Bredin-Archbold-Smithsonian Biological Survey of Dominica, where the types were collected.

Over this wide area of distribution the males all agree with the holotype from Dominica. Females caught with typical males from Brazil and Puerto Rico, however, do not agree with the females from Dominica which we at this time regard as being *archboldi*.

Specimens of both sexes from Jamaica are larger as shown by the mean wing length of 1.3 mm in six male specimens compared with a mean of 0.88 mm in nine Dominican males; in females the respective values are 1.04 mm and 0.84 mm. The antennal and tarsal ratios, however, are much the same in specimens from both islands.

Forcipomyia (Pedilohelea) brinchangensis de Meillon and Wirth,

NEW SPECIES

Figs. 24–28

Male.—Described from the holotype and 1 other male. Wing length 1.3 mm. *Head*: Palpus with 3rd segment (Fig. 24) only slightly swollen basally, without a marked sensory organ, a patch of sensilla present at proximal 1/3. Antenna with lengths of segments XII–XV in proportion of 95–55–40–50; antennal ratio 1.0. *Thorax*: Costal ratio of wing 0.46. Legs with tarsal ratios of fore and mid legs 0.63 and 0.42 (mid leg incomplete in both specimens); fore tibia with subapical comb of closely packed transparent spines.

Genitalia (Figs. 26–29): Dististyle (Fig. 26) narrow and straight, not sinuous as in other species, apex rounded and without flange. Aedeagus triangular, ending in a long spear like spike (Fig. 27). Parameres fused, basal 1/2 slightly expanded, apically separated and not crossed, sclerotized and bearing a small ventral beak best seen in side view (Fig. 28).

Female.—A specimen taken at the same time is described as the female of this species. Wing length 1.0 mm. *Head*: Palpus (Fig. 24) as in male. Antenna with lengths of segments XI–XV in proportion of 55-55-55-50-60; antennal ratio 1.30. *Thorax*: Costal ratio of wing 0.45. Legs with tarsal ratios of fore, mid and hind legs 0.9, 0.6, 0.6; fore tibia without the comb of transparent spines seen in the male. *Abdomen*: Spermathecae (Fig. 25) two, subequal, elongate ovoid, without neck, each measuring 0.050 by 0.031 mm.

Distribution.—Malaysia.

Types.—Holotype, ♂, Mt. Brinchang, Pahang, Malaysia, 5–6000 ft., March 1963, H. E. McClure, light trap (USNM Type no. 67533). Paratype, 1 ♂, same data.

Other Specimen Examined.—MALAYSIA: Same data as type, 1 ♀.

Discussion.—The specific epithet is an adjective referring to the type-locality. The female is not made a paratype because the discrepancies in the tarsal ratios cast some doubt on its conspecificity with the male holotype.

Forcipomyia (Pedilohelea) clastrieri Dessart

Figs. 1–12

Lepidohelea brevitarsata Clastrier, 1959: 345 (♂, Senegal; fig. palpus, genitalia; preocc. in *Forcipomyia* by *Lasiohelea brevitarsata* Ingram and Macfie, 1924).

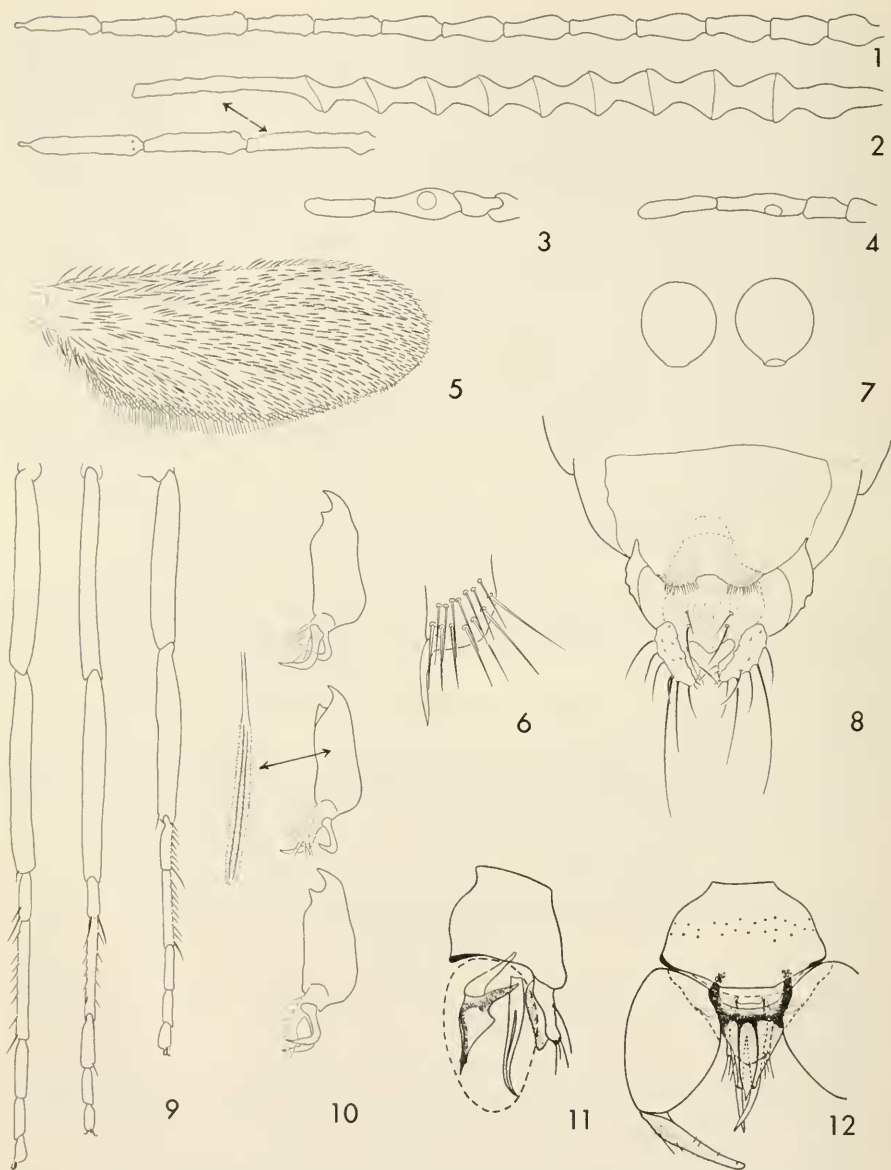
Forcipomyia nilotheres Macfie, misident.; Clastrier and Wirth, 1961: 191 (Nigeria record).

Forcipomyia (Forcipomyia) clastrieri Dessart, 1963a: 183 (replacement name for *brevitarsata* (Clastrier); ♂, ♀ described; figs.; Nigeria); Dessart, 1963b: 56 (descriptive notes; synonymy).

Male.—Wing length 0.92 mm. *Head*: Palpus (Fig. 4) with 3rd segment swollen basally, sensory organ distinct and located at proximal $\frac{1}{3}$ (not demarcated in São Tomé specimens). Antenna (Fig. 2) with lengths of segments XII–XV in proportion of 70-40-30-40; antennal ratio 0.96. *Thorax*: Costal ratio of wing 0.47. Legs with tarsal ratios of fore, mid and hind legs 0.67, 0.30, 0.39.

Genitalia (Figs. 11–12): Dististyle moderately sinuate, gradually tapering to rounded apex. Aedeagus triangular, tapering to narrow apex bearing medially a short sharp point. Parameres joined basally; each long and slender, distally lanceolate and crossed as in a pair of scissors.

Female.—Wing length 0.85 mm. *Head*: Palpus (Fig. 3) as in male but more swollen basally; sensory organ distinct except in specimens from São Tomé. Antenna (Fig. 1) with lengths of segments XI–XV in proportion of 26-26-25-26-34; antennal ratio 1.25. *Thorax*: Costal ratio of wing (Fig. 5) 0.45. Legs (Fig. 9) with tarsal ratios of fore, mid and hind legs 0.68, 0.34, 0.40. *Abdomen*: Spermathecae (Fig. 7) two, one usually globular and the



Figs. 1-12. *Forcipomyia clastrieri*. 1, Female antenna. 2, Male antenna. 3, Female palpus. 4, Male palpus. 5, Female wing. 6, Hind tibial comb. 7, Spermathecae. 8, Female genital segments. 9, Legs of female (left to right, hind, mid, and fore legs). 10, Fifth tarsomeres and claws of female (top to bottom, fore, mid, and hind legs; left, enlarged detail of scalelike vestiture). 11, Male genitalia, side view. 12, Male genitalia, ventral view.

other slightly ovoid; subequal in size, in 5 specimens minimum and maximum lengths 0.031–0.038 and 0.029–0.035 mm respectively for the two.

Distribution.—West Africa.

Specimens Examined.—GHANA: Tafo, West African Cocoa Research Institute, 12–17 March 1962, B. M. Gerrard, light trap, 1 ♂. NIGERIA: Ibadan, Sept. 1962, D. C. Eidt, Malaise trap, 1 ♂, 16 ♀ (Canadian National Collection). Kaduna, Zaria Prov., 10 Nov. 1956, B. McMillan, from tree hole, 1 ♂, 1 ♀. Sapoba, Sept. 1962, D. C. Eidt, Malaise trap, 2 ♀ (CNC). SÃO TOMÉ: 26 Dec. 1974, J. Derron, from cocoa flowers, 4 ♂, 2 ♀.

Discussion.—The variation in the degree of demarcation of the sensory organ of the third palpal segment once again shows the difficulties with identification of females of *Pedilohelea*.

Forcipomyia (Pedilohelea) draconis de Meillon and Wirth, NEW SPECIES
Figs. 29–30

Male.—Described from the holotype. Wing length 1.06 mm. *Head*: Palpus with 3rd segment slightly expanded on proximal $\frac{1}{2}$, distal portion slender and parallel sided; no demarcated sensory organ, the sensilla borne on surface of segment just proximad of mid length. Antenna broken, distal segments missing. *Thorax*: Costal ratio of wing 0.39. Legs with tarsal ratios of fore and hind legs 0.77 and 0.58 respectively; mid legs damaged.

Genitalia (Figs. 29–30): Dististyle markedly swollen on proximal $\frac{2}{3}$, tapering abruptly distally to slender beaklike tip. Aedeagus with short, stout basal arms; main body only slightly swollen at base, nearly parallel sided in midportion; distal end with 2 rounded lateral lobes between which a short, pointed, median lobe projects caudoventrad, much as in *F. aitkeni*, but with the proportions of the lobes to a much different scale. Parameres joined basally a short distance; free arms in shape of stout, slightly curving blades with their bluntly pointed apices meeting distally.

Distribution.—Transvaal.

Type.—Holotype, ♂, Newington, Pilgrims Rest Distr., Transvaal, 16–19 April 1964, E. Haeselbarth (deposited in South African Institute for Medical Research, Johannesburg).

Discussion.—The species takes its name *draconis* (Latin genitive of *draco* “dragon,” a Latin loanword from Greek) from the Drakensberg, the mountainous area where the type was collected.

Forcipomyia draconis has such distinctive male genitalia, with proximally swollen dististyle, distally trilobed narrow aedeagus, and stout bladelike parameres, that we do not hesitate to name and describe it from the slightly damaged holotype, which lacks the distal antennal segments and the distal four tarsomeres of the mid legs.

Forcipomyia (Pedilohelea) eshowensis de Meillon

Figs. 46-47

Forcipomyia eshowensis de Meillon, 1937: 361 (♂; Zululand; fig. genitalia).

Male.—Redescribed from the holotype. Wing length 1.18 mm. *Head*: Palpus with 3rd segment slightly expanded in mid portion with no demarcated sensory organ, a clump of sensilla present just proximad of mid length. Antenna damaged; that of Ghanian specimen with lengths of segments XII-XV in proportion of 83-40-33-43; antennal ratio 1.0. *Thorax*: Costal ratio of wing 0.43. Legs with tarsal ratios of fore, mid, and hind legs 0.54, 0.34, 0.39.

Genitalia (Figs. 46-47): Dististyle sinuous and evenly tapered to a beak-like tip. Aedeagus swollen basally and narrowing to sharp point distally, membranous for the most part. Parameres joined basally, posterior margin of the juncture narrowly rounded; the free arms strong, stiff, and sclerotized, parallel subapically with bluntly pointed tips touching apically.

Distribution.—South and West Africa.

Type.—Holotype, ♂, Eshowe, Zululand, 20 November 1936, B. de Meillon, taken at light (in South African Institute for Medical Research, Johannesburg, borrowed for study through the courtesy of the Director, Dr. J. Metz).

New Record.—GHANA: Tafo, West African Cocoa Research Institute, 12-17 March 1962, B. M. Gerrard, light trap in cocoa plantation, 1 ♂.

Discussion.—This species is related to *F. forcipis* from Malaysia, but in that species the aedeagus is poorly sclerotized distally and the parameres are fused on the proximal $\frac{2}{3}$ of their length.

Forcipomyia (Pedilohelea) forcipis de Meillon and Wirth, NEW SPECIES

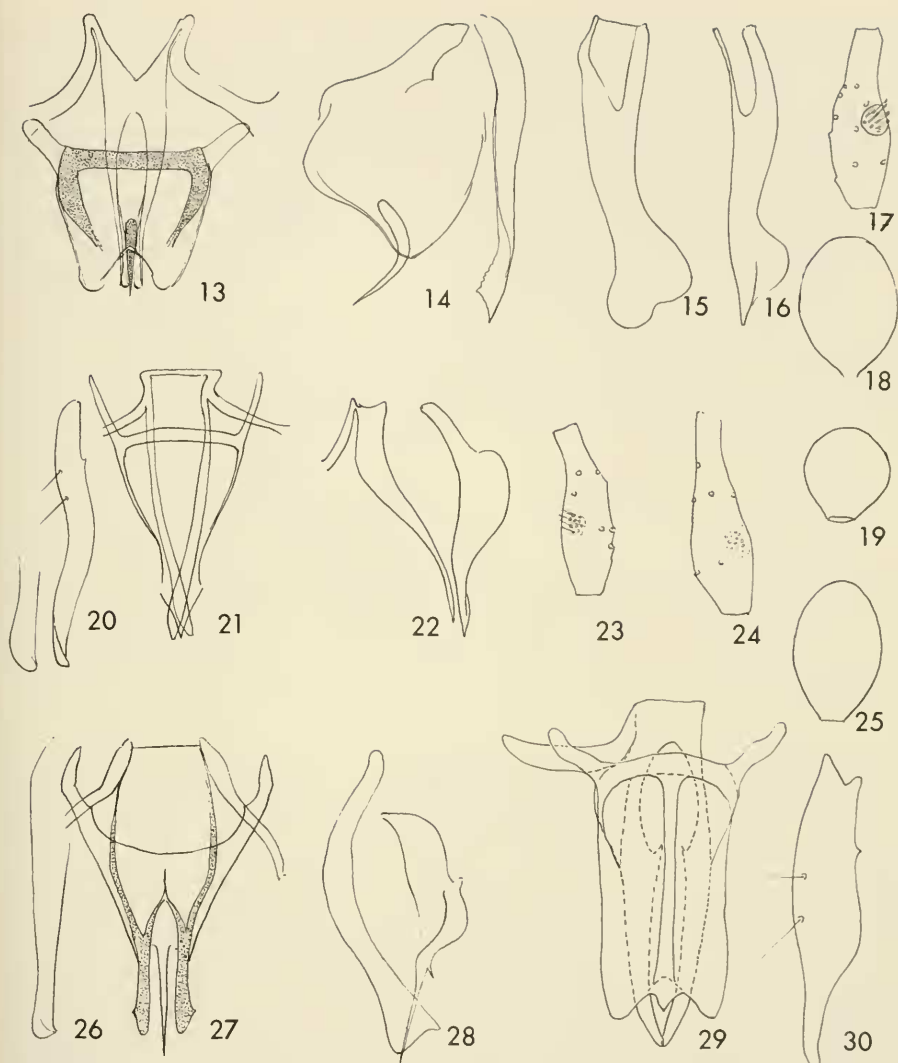
Figs. 31-32

Male.—Described from the holotype. Wing length 0.95 mm. *Head*: Palpus not well displayed but obviously 4-segmented; 3rd segment apparently without a marked sensory organ. Antenna with lengths of segments XII-XV in proportion of 65-40-35-43; antennal ratio 0.98. *Thorax*: Costal ratio of wing 0.47. Legs with tarsal ratios of fore, mid and hind legs 0.67, 0.37, 0.40.

Genitalia (Figs. 31-32): Dististyle as usual in the subgenus; sinuous, narrowing gradually to apex. Aedeagus triangular, apex membranous and sharply pointed. Parameres heavily sclerotized apically, broadly joined on proximal $\frac{2}{3}$; free parts short, strong, curved towards each other as in a pair of tongs or forceps.

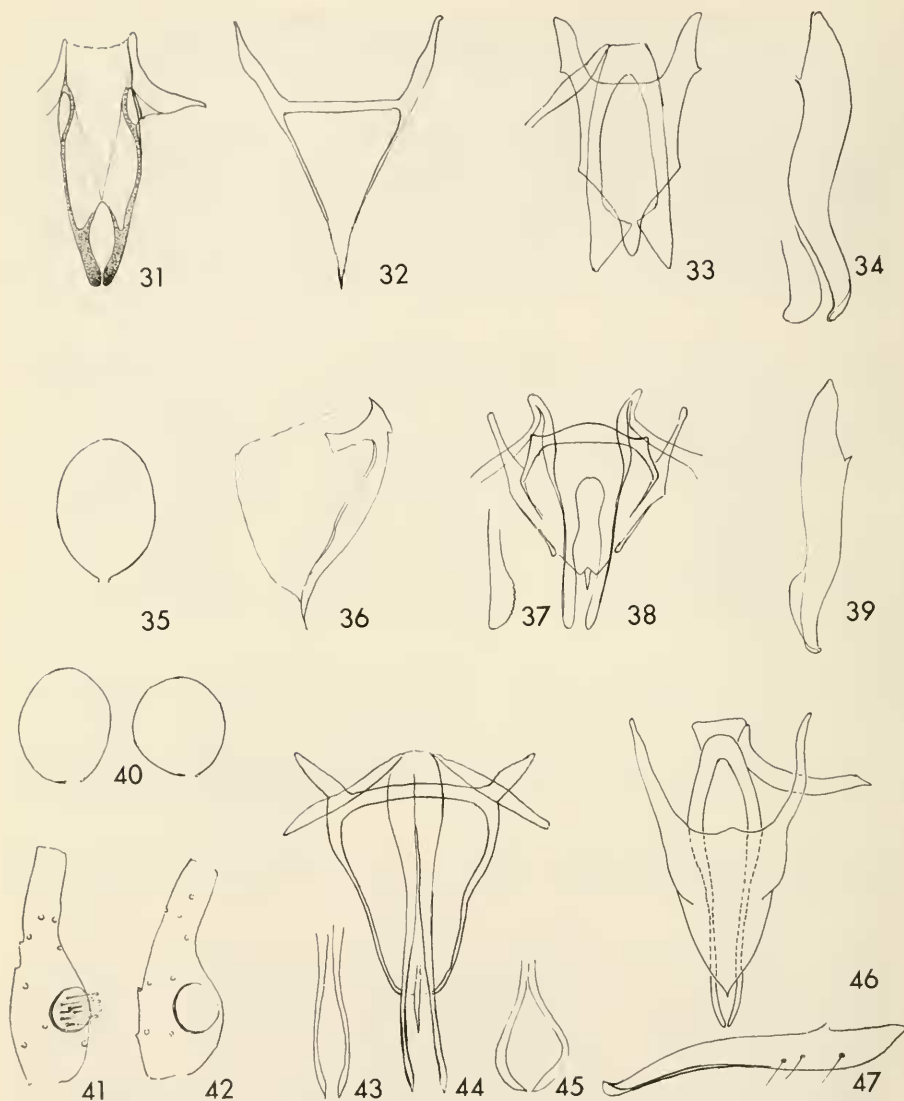
Distribution.—Sabah, Malaysia.

Type.—Holotype, ♂, Tambunan, Sabah, Malaysia, April 1952, D. H. Colless, swept (deposited in C.S.I.R.O., Canberra, Australia).



Figs. 13-18. *Forcipomyia aitkeni*; 19-23. *F. archboldi*; 24-28. *F. brinchangensis*; 29-30. *F. draconis*. 13, 21, 27, 29, Aedeagus and parameres in ventral view. 14, 22, 28, Same in side view. 15, 16, 20, 26, 30, Dististyle. 17, 23, 24, Male third palpal segment. 18, 19, 25, One of the two female spermathecae.

Discussion.—The specific epithet is a Latin genitive, referring to the forcepslike male parameres. This species appears to be the Southeast Asian counterpart of *F. eshowensis* de Meillon from West Africa, differing markedly in the shape of the aedeagus and parameres.



Figs. 31-32. *Forcipomyia forcipis*; 33-34. *F. raposoi*; 35-39. *F. spangleri*; 40-45. *F. spilmani*; 46-47. *F. eshowensis*. 31, Parameres in ventral view. 32, Aedeagus in ventral view. 33, 38, 44, 46, Aedeagus and parameres in ventral view. 36, Same in side view. 34, 39, 47, Dististyle. 35, 40, Spermathecae. 37, Apex of paramere in side view. 41, Third palpal segment of male. 42, Same, female. 43, Apices of parameres of holotype. 45, Same of specimen from Brazil.

Forcipomyia (Pedilohelea) raposoi de Meillon and Wirth, NEW SPECIES
Figs. 33–34

Male.—Described from the holotype. Wing length 1.20 mm. *Head*: Palpus with 3rd segment slightly swollen on basal $\frac{1}{2}$ and bearing a demarcated sensory pit in middle of segment. Antenna with lengths of segments XII–XV in proportion of 80–55–40–45; antennal ratio 0.95. *Thorax*: Wing with costal ratio 0.40. Legs with tarsal ratios of fore, mid and hind legs 0.5, 0.3, 0.4; fore tibia appearing to have an apical comb of transparent, closely set spines.

Genitalia (Figs. 33–34): Dististyle (Fig. 34) sinuous, narrowing to apex where it bears a small flange. Aedeagus much longer than wide, apically fashioned into a fingerlike termination (Fig. 33). Parameres narrowly joined basally, each a parallel-sided ribbon with triangular-shaped apex as illustrated (Fig. 33).

Distribution.—Colombia.

Type.—Holotype, ♂, Rio Raposo, Valle, Colombia, 23 March 1964, V. H. Lee, light trap (USNM Type no. 67237).

Discussion.—The specific epithet is a Latin genitive referring to the type-locality. This species is unusual in the subgenus in having the parameres expanded distally into a broad triangular shape.

Forcipomyia (Pedilohelea) spangleri de Meillon and Wirth, NEW SPECIES
Figs. 35–39

Male.—Described from the holotype, one male from Colombia, and one male from Panama. The figures in parentheses are the mean measurements of the holotype and the two other specimens. Wing length 0.8 (0.73) mm. *Head*: Palpus with 3rd segment slightly swollen on basal $\frac{1}{2}$ with a demarcated sensory organ at about midlength. Antenna with lengths of segments XII–XV in proportion of 50–30–20–25 (45–28–22–37); antennal ratio 1.2 (1.2). *Thorax*: Costal ratio of wing 0.4 (0.4). Legs with tarsal ratios of fore, mid and hind legs 1.2, 0.8, 0.8 (0.97, 0.80, 0.78).

Genitalia (Figs. 36–39): Dististyle (Fig. 39) with a large flange apically giving rise to a variety of shapes according to precise orientation. Aedeagus triangular in outline, about as wide basally as long, apex with a small median tooth. Parameres (Fig. 38) running parallel to one another but separated beyond the basal part where they are fused; each membranous, ribbonlike, and poorly defined along medial margin up to apex; in some views each slightly expanded apically where minutely serrate (Fig. 37).

Female.—Described from allotype with measurements from five topotypes in parentheses. Wing length 0.7 (0.7) mm. *Head*: Palpus as in male. Antenna with lengths of segments XI–XV in proportion of 20–18–18–15–25 (20–18–19–19–24); antennal ratio 1.4 (1.3). *Thorax*: Costal ratio of wing 0.4

(0.4). Legs with tarsal ratios of fore, mid and hind legs 1.3, 0.8, 0.8 (1.2, 0.8, 0.8).

Abdomen: Spermatheca (Fig. 35) two, ovoid with a slight neck; subequal, collapsed in all mounts, but one which was macerated in potash and relaxed in phenol alcohol expanded to normal size and measured 0.062 mm in length and slightly less in width.

Distribution.—Guatemala, Panama, Colombia, Ecuador.

Types.—Holotype, ♂, allotype, ♀. Suchitepequez, San Antonio Suchitepequez, Guatemala, 6 July 1965, P. J. Spangler, Malaise trap (USNM Type no. 65711). Paratypes, 1 ♂, 5 ♀, same data as types.

Other Specimens Examined.—COLOMBIA: Rio Raposo, Valle, May 1965, V. H. Lee, light trap, 1 ♂. ECUADOR: Quevedo, Pichilingue INIAP, Apr. 1978, J. Mendoza, reared from decomposing organic material, 11 ♂, 10 ♀. PANAMA: Barro Colorado Island, C. Z., July 1967, W. W. Wirth, light trap, 1 ♂.

Discussion.—This species is named for Paul J. Spangler of the Smithsonian Institution in appreciation of his interest and help in collecting many new and interesting Neotropical biting midges.

Because of the unusual tarsal ratios there seems little doubt that the females belong to *F. spangleri*, and hence we do not hesitate to designate an allotype for this species.

Forcipomyia (Pedilohelea) spilmani de Meillon and Wirth, NEW SPECIES
Figs. 40–45

Male.—Described from the holotype with mean measurements from 7 paratypes in parentheses. Wing length 1.1 (1.04) mm. *Head*: Palpus (Fig. 41) with 3rd segment swollen on basal $\frac{1}{2}$ with a demarcated sensory organ and a patch of capitate sensilla. Antenna with lengths of segments XII–XV in proportion of 80-45-35-40 (71-44-38-43); antennal ratio 0.9 (0.9). *Thorax*: Costal ratio of wing 0.4 (0.4). Legs with tarsal ratios of fore, mid and hind legs 0.5, 0.3, 0.4 (0.5, 0.3, 0.4).

Genitalia (Figs. 43–45): Dististyle narrow, sinuous, and of almost even width throughout, much as in *archboldi*; apex beaklike with small dorsal flange. Aedeagus (Fig. 44) triangular, apex membranous with a median spine which is difficult to see in many specimens. Parameres joined basally, slightly bulbous where closely approximated, each narrowing gradually to a point tip.

Female.—Described from 6 specimens caught at the same time and place as the males. Wing length 0.97 mm. *Head*: Palpus (Fig. 42) as in the male with a demarcated sensory organ. Antenna with lengths of segments XI–XV in proportion of 29-29-29-31-38; antennal ratio 1.0. *Thorax*: Costal ratio of wing 0.44. Legs with tarsal ratios of fore, mid and hind legs 0.5, 0.3, 0.4;

in some specimens a closely packed apical comb of transparent spines can be seen on fore tibia, it is possible that this comb, which is small and difficult to see, is present more often than is apparent. *Abdomen*: Spermathecae (Fig. 40) two, somewhat variable in shape but generally as figured; subequal, each measuring 0.040 by 0.030 mm.

Distribution.—Dominica, Trinidad, Panama, Colombia, Brazil.

Types.—Holotype, ♂, Clarke Hall, Dominica, Sept. 1964, T. J. Spilman, light trap (USNM Type no. 73565). Paratypes, 54 ♂, 36 ♀, as follows: DOMINICA: Carholm Estate, 7 Feb. 1965, W. W. Wirth, sweeping, 3 ♂, 2 ♀. Castle Bruce Jctn., 21 March 1956, J. F. G. Clarke, 1 ♂, 1 ♀. Clarke Hall, April, June 1964, O. S. Flint, light trap, 2 ♀; Sept. 1964, T. J. Spilman, light trap, 12 ♂, 3 ♀. Fond Figue River, 25 Jan. 1965, W. W. Wirth, rain forest, 1 ♂, 3 ♂. d'Leau Gommier, 15 Feb. 1965, W. W. Wirth, stream margin, 1 ♂. Point Lolo, 0.5 mi W, 25 Jan. 1965, W. W. Wirth, at light, 1 ♂, 1 ♀. Pont Casse, 0.4 mi W, June 1964, O. S. Flint, at light, 12 ♂, 9 ♀; 1.6 mi W, June 1964, O. S. Flint, at light, 9 ♂, 5 ♀; April 1964, O. S. Flint, at light, 4 ♂, 2 ♀; 1 mi E, 29 Jan. 1965, W. W. Wirth, light trap, 1 ♂, 1 ♀; 1.7 mi E, 12 March 1965, W. W. Wirth, light trap, 3 ♀; 1.5 mi N, 12 Feb. 1965, W. W. Wirth, rain forest, 2 ♂, 3 ♀; 2.0 mi W, Jan. 1965, W. W. Wirth, 2 ♂, 1 ♀. South Chiltern Estate, 7 Feb. 1965, W. W. Wirth, sweeping, 3 ♂, 2 ♀.

Other Specimens Examined.—COLOMBIA: Rio Raposo, Valle, 1963–1965, V. H. Lee, light trap, 14 ♂, 4 ♀. PANAMA: Barro Colorado Island, C. Z., July 1967, W. W. Wirth, light trap, 1 ♂, 1 ♀. BRAZIL: Nova Teutonia, Santa Catarina, 1963–1965, F. Plaumann, 3 ♂. TRINIDAD: La Fortuna Estate, Vega de Oropouche, Sept. 1958, T. H. G. Aitken, 1 ♂, 3 ♀.

Discussion.—This species is named for Theodore J. Spilman of the Systematic Entomology Laboratory, USDA, who collected the holotype, along with many other new ceratopogonids, during his tour with the Biological Survey of Dominica.

The swelling on the basal half of the third palpal segment, though somewhat variable, is generally more pronounced than in the females of other species. *F. spilmani* keys out with *F. spangleri*, but in addition to the great differences in size, antennal ratio, and tarsal ratios, the males can readily be distinguished by the shapes of the parameres. Females of *F. spilmani* can be distinguished in Dominica from those of *archboldi* by the distinct palpal pit and the much lower tarsal ratios.

LITERATURE CITED

- Clastrier, J. 1959. No tes sur les Cératopogonidés. VII.—Cératopogonidés d'Afrique occidentale Française (1). Arch. Inst. Pasteur Algér. 37: 340–383.
Clastrier, J. and W. W. Wirth. 1961. Notes sur les Cératopogonidés. XII.—Cératopogonidés de la Région Éthiopienne. Arch. Inst. Pasteur Algér. 39: 190–240.

- Dessart, P. 1963a. Contribution a l'étude des Ceratopogonidae (Diptera). VI.—Remarques sur quelques especes du genre *Forcipomyia*. Bull. Ann. Soc. Entomol. Belg. 99: 182–188.
- . 1963b. Contribution a l'étude des Ceratopogonidae (Diptera) (VII). Tableaux dichotomiques illustrés pour la détermination des *Forcipomyia* Africains. Mem. Inst. Roy. Sci. Nat. Belg. (2 Ser.) 72: 1–151, 16 plates.
- Ingram, A. and J. W. S. Macfie. 1924. Notes on some African Ceratopogoninae—Species of the genus *Lasiohelea*. Ann. Trop. Med. Parasitol. 18: 377–392, 1 plate.
- Meillon, B. de. 1937. Entomological Studies. Studies on insects of medical importance from southern Africa and adjacent territories (Part IV). Ceratopogonidae. 2. Records and species from South Africa. Publ. S. Afr. Inst. Med. Res. 7: 332–385.
- Soria, S. de J. 1976. Tabelas etárias dos polinizadores do cacauero *Forcipomyia* spp. (Diptera, Ceratopogonidae) em condições de Laboratorio. Rev. Theobroma 6(1): 5–13.
- Soria, S. de J. and W. W. Wirth. 1976. Ciclos de vida dos polinizadores do cacauero *Forcipomyia* spp. (Diptera, Ceratopogonidae) e algumas anotações sobre o comportamento das larvas no laboratorio. Rev. Theobroma 5(4): 3–22.
- Wirth, W. W. and N. C. Ratanaworabhan. 1978. Studies on the genus *Forcipomyia*. V. Key to subgenera and description of a new subgenus related to *Euprojoannisia* Bréthes (Diptera: Ceratopogonidae). Proc. Entomol. Soc. Wash. 80: 493–507.